SIDAC

Supportability Investment Decision Analysis Center

Contract No. F33657-92-2055/0109
CDRL A001a, Data Item DI-MGMT-80508
SID/TR-95/0398

(Unclassified)

FINAL TECHNICAL REPORT

on

WR-ALC C-141 and TI Directorate Performance Measurement Assessment

Prepared for
WR-ALC/RE
Depot Reengineering Team
320 Second St., Suite 200
Robins AFB GA 31098-1638

November 30, 1995

Prepared by:
Battelle Arlington Operations
5001 Eisenhower Ave., Rm 1S31
Arlington VA 22233

Submitted by
SIDAC
5100 Springfield Pike
Dayton, OH 45431

Contract No. F33657-92-2055/0109
CDRL A001, Data Item DI-MGMT-80508
Report No. SID/TR-95/0398

(Unclassified)

Final Technical Report

for

WR-ALC C-141 and TI Directorate Performance Measurement Assessment

Prepared for

WR-ALC/RE
Depot Reengineering Team
320 Second St., Suite 200
Robins AFB GA 31098-1638

November 30, 1995

Prepared by
Battelle Arlington Operations
5001 Eisenhower Ave., Room 1S31
Arlington VA 22233

Submitted by
SIDAC
5100 Springfield Pike, Suite 110
Dayton, OH 45431

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE

3. REPORT TYPE AND DATES COVERED

4. TITLE AND SUBTITLE
WR-ALC C-141 and TI Directorate Performance Measurement Assessment

5. FUNDING NUMBERS
Contract No.
F33657-92-D-2055
Delivery Order No.
0109

6. AUTHOR(S)
Roddy, Mark B.
Hostick, Cody
Black, Don

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Battelle
2101 Wilson Blvd, Suite 800
Arlington, VA 22201-3008

8. PERFORMING ORGANIZATION REPORT NUMBER
51D12465

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
HQ AFMC/SCXR
4225 Logistics Avenue, Suite 11
Wright-Patterson AFB, OH 45433-5750

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
51D/TR-95/0398

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for Public Release; Distribution is Unlimited

12b. DISTRIBUTION CODE
A

13. ABSTRACT (Maximum 200 words)

This assessment reviews the performance measures used by the Warner Robins Air Logistics Center's (WR-ALC) C-141 Aircraft Production, Technology and Industrial Support Directorate and the 78 Air Base Wing Supply Division to measure their support of C-141 reparable and manufactured parts support in conjunction with C-141 programmed depot maintenance (PDM). The study determined that, as part of an ongoing business process reengineering project guided by WR-ALC's Reengineering Office, each organization is developing metrics which support their part of the production "pipeline." However, there was no overarching metric being developed which all three organization could use as a common metric to measure total production pipeline performance. Therefore, the study recommends the adoption of the C-141 Required Delivery Date (RDD), set during the C-141 PDM, as the common metric for measuring organizational performance in support of C-141 PDM production. The study also recommends a near-term review of in use and planned management information systems to ensure they meet the users' needs and expectations.

14. SUBJECT TERMS

15. NUMBER OF PAGES
43

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

WR-ALC C-141 AND TI DIRECTORATE PERFORMANCE MEASURE ASSESSMENT

Mark Roddy
Cody Hostick
Don Black

NOVEMBER 1995

Prepared for the
United States Air Force
under SIDAC Contract F33657-92-D-2055

Battelle Memorial Institute
505 King Avenue
Columbus OH 43201-2693

Acknowledgments

Battelle would like to thank the individuals from Warner Robins Air Logistics Center (WR-ALC) who assisted in providing the information used in the execution of this study. To the fullest extent possible, this study incorporates relevant data and guidance received from WR-ALC participants. While all participants are listed in Attachment 1, key individuals participating in this study include the following:

Roy Abbott	WR-ALC/RE
Captain John Folmar	WR-ALC/RE
Jerry Ethridge	WR-ALC/TI/RE
Neil Pernell	WR-ALC/LJPC
Lonnie Thibault	WR-ALC/LGS
Joe Wilson	WR-ALC/TI/RE
Henry Campbell	WR-ALC/LJPL

Summary of Results and Recommendations

Under the direction of the Warner Robins Air Logistics Center (WR-ALC) Reengineering Office, personnel in the C-141 Management Directorate's Production Branches (WR-ALC/LJ), the Technology & Industrial Support Directorate (WR-ALC/TI) and the Supply Division (78 ABW/LGS) have taken great steps towards reengineering and improving the process by which reparable items and requests for manufacturing support flow between LJ and TI. All agencies are working in a cooperative effort, and all are moving towards activation of a process which should reap significant benefits to the ALC in terms of both reducing C-141 aircraft depot flow time while simultaneously enhancing product quality.

As part of these efforts, LJ, TI and LGS are reviewing existing metrics and developing new ones to unilaterally track their performance under the new process. We found these proposed metrics to be generally sound, and in line with recognized business process re-engineering metric criteria. However, we also detected the lack of a metric which could measure performance of the each of these organizations in reference to the overall C-141 reparable/manufacturing requirements generation and resolution process.

Therefore, we recommend adoption of a metric which measures each organization's performance against the required delivery date (RDD) set by the C-141 production function. Such a metric would focus support efforts on the C-141 production customer: the technician needing the part. This, in turn, would improve support to the ultimate customer: the Air Mobility Command (AMC). Use of this metric would dictate that realistic delivery dates be established by LJ, a goal which they have already set for themselves. Additionally, it would provide all agencies involved in the process, as well as all levels of management, total C-141 Production Pipeline visibility, by measuring the process against a common metric: RDDs met. The use of RDDs as a metric is also in line with WR-ALC's Lean Logistics emphasis on "Issue Effectiveness."

A RDD-based metric would also allow for better prioritization of workload by the TI repair and manufacturing functions, as opposed to current practice in which schedulers, planners and shop supervisors must respond to a wide spectrum of formal and informal priorities. By combining finite capacity scheduling, TI's proposed "green, yellow and red" priority scheduling procedure and realistic RDDs, those items which are lead time critical can be easily and effectively highlighted for the management attention needed to ensure their expeditious movement through the repair/manufacturing process and return to the aircraft.

LGS, as the single focal point for parts ordering/manufacturing/repair requests within the C-141 production effort, would also benefit from a RDD-based metric. LGS would be provided a clear target date, against which they could evaluate the options open to them (i.e., routing items to TI,

requisitions from DLA stocks, and/or local purchase/production) to fill requirements.

Although beyond the scope of this effort, we encountered a potential stumbling block to quantitative process improvement - that being the inability of current information infrastructure to effectively support the productive sharing of information across the maintenance activities enterprise. The performance of the entire organization, as well as the utility of an overarching performance metric (such as RDD conformance) could be greatly enhanced through more effective information sharing. While we were not able to spend much time researching this issue, several different and non-connected systems (PDMSS, Make-IT, and LGS legacy systems) are currently in use by each of the major players in the C-141 production process. DoD has directed the implementation of DMMIS throughout all Service depots as the depot maintenance management migration application. However, it was apparent to us that potential users have serious concerns about DMMIS' ability to provide the same level of functionality for their portion of the production pipeline as that currently available through the in-use systems. This concern could impact DMMIS' acceptance, utilization, and ultimately, its effectiveness. The issue of a comprehensive and user-accepted pipeline visibility information system must be addressed in a timely manner to avoid serious, near term disruption of the C-141 PDM process, and the ALC's implementation of Lean Logistics.

Contents

1.0 Purpose of Study

Downsizing by the Department of Defense and the United States Air Force (USAF) requires Warner Robins Air Logistics Center (WR-ALC) to provide customers support equal to or better than that provided today, but at a lower cost. To meet this challenge of doing more with less through Lean Logistics (LL), WR-ALC has embraced Business Process Reengineering (BPR). As part of the on-going BPR effort, Battelle Memorial Institute has been contracted to provide technical support with the purpose of improving WR-ALC's competitive posture through the identification of applicable business performance metrics. The scope of this support and the approach used to accomplish this study is presented in the following sections.

1.1 Scope of Work

The scope of work of this study was to review the performance measures used to manage workload between the C-141 Management Directorate's (LJ) aircraft production branches (hereafter referred to as C-141 Production), and the Technology & Industrial Support (TI) Directorate. The project's statement of work (SOW) listed the following activities for Battelle to complete within an eight week period of performance:

- Identify Existing Measures of Performance for Routed Items
- Calibrate Performance Measures of Selected Items
- Identify Performance Measure Congruence Between Directorates
- Recommend Best Metrics for Measuring Reparable Item Flow

The Battelle Team, after consultation with WR-ALC/RE determined performance measures would be reviewed in terms of:

- proposed metrics,
- lack of measurements,
- inappropriate measurements,
- conflicting measurements.

It is important to note that this study focuses solely on performance measurement issues. Redesign of the business processes, such as Lean Logistics implementation, is beyond the scope of this effort, and is currently being addressed by on-going WR-ALC reengineering activities. However, we do recognize that the processes and activities described in this report do play a role in these other initiatives, particularly Lean Logistics.

C-141 Production and the TI directorate were selected by the WR-ALC Reengineering Team as they represent two of the most vital and largest WR-ALC depot organizations. Effective

measures that promote responsive and efficient interactions between these two organizations maintain and enhance the overall competitiveness of WR-ALC.

As stated in the SOW, the initial study focus concentrated on reparable item flow between the C-141 Production and TI organizations. However, early discussions with the WR-ALC Reengineering Team indicated that parts requiring local manufacturing (i.e., needing to be produced by TI) were a significant element in regards to C-141 Production/TI interactions. The Battelle scope of work was expanded at no cost to the Government to include a review of all parts flow between the two organizations. The tremendous work that had been done by the WR-ALC Reengineering Team participants in this area prior to the start of this study provided much of the information needed by the Battelle team, making this no-cost expansion of the scope of work possible.

Additionally, another issue arose which was outside the scope of the SOW: the lack of a comprehensive pipeline visibility information management system. Although we were not able to study this important issue in detail, we have included some observations and a recommendation concerning this in the report.

1.2 Study Approach

The approach used by the Battelle study team consisted of viewing the total flow of parts to/from the C-141 Production and TI organizations as an integrated "pipeline". Performance measures throughout this existing pipeline were reviewed to determine how they contribute to overall pipeline effectiveness, with the emphasis, at the request of LJ and TI, being placed on "TO BE" versus "AS IS" metrics. This macro view of the entire pipeline is in contrast to reviewing how performance measures contribute to each individual component organization's effectiveness.

Battelle participants based their review of existing and planned C-141 Production and TI performance measures on two factors:

1. Fundamental manufacturing/repair performance measure "design principles,"

2. Effective performance measures used in the private sector.

A discussion of performance measure design principles and examples are provided in Section 2. This discussion lays the foundation for an assessment of existing and planned C-141 Production, 78 ABW Supply Division (hereafter referred to as LGS), and TI performance measures against these design principles. This assessment and the Battelle study team's observations are provided in Section 3. Conclusions are listed in Section 4, and recommendations resulting from this assessment are summarized in Section 5.

2.0 Performance Measure Design Principles

Performance measures represent the "feed-back" from a manufacturing/repair enterprise. This feed-back, like an instrument panel in a vehicle, enables managers to determine, monitor and correct conditions as needed to achieve performance objectives. Measures can be meaningful and can keep managers and workers alike informed regarding performance (e.g., speedometer), as well as providing information regarding conditions that effect performance (e.g., temperature and gas gauges). Performance measures can also be interesting but useless (e.g., a tachometer in a car equipped with an automatic transmission), or even misleading. There are design principles that are available to help establish useful and meaningful performance measures that can be used to improve the performance of a manufacturing/repair enterprise.

2.1 Performance Measure Design Principles

There are seven fundamental design principles that should be considered in developing performance measures for competitive manufacturing/repair environments:

Design Principle No.1 Performance Measures Must Directly Relate To The Business and Manufacturing/Repair Strategy

The business strategy is what an organization has determined it needs to do to remain or become competitive and meet its customer's expectations. Business strategies are built using one or more of the following four business concepts:

1. Lowest Cost Provider
2. Highest Quality Provider
3. Fastest/Shortest Lead Time Provider
4. Most Innovative/Most Flexible Provider

Once an organization determines its business strategy, a manufacturing/repair strategy can be determined. For example, if the business strategy is to be the Lowest Cost Provider in the marketplace, the manufacturing/repair strategy consists of squeezing out all non-valued added steps in the manufacturing/repair process. If the business strategy is to be the Fastest/Shortest Lead Time Provider, the manufacturing/repair strategy might include the use of agile manufacturing/repair practices (a.k.a, lean logistics, just-in-time, quick response).

Realistically, most firms do not focus on just one business strategy but on a combination of business strategies. They do this by having a primary as well as a secondary objective, like:

"We will be the shortest lead time provider",	=	Primary Objective
"while reducing cost".	=	Secondary Objective

Defining the business and supporting manufacturing/repair strategies determines the performance measures that an organization should care about. If the strategy is to reduce costs, measures need to focus on costs per transaction, hours of value-added labor versus total labor, etc. If the strategy is to reduce time/improve responsiveness, measures need to focus on cycle-time and customer service levels. If an organization has a combination strategy, it will have primary and secondary measures in support of each. It is important, particularly with a combination business strategy, to communicate the relative importance of the supporting measures. This is addressed by the next design principle.

Design Principle No.2 People Focus On What Is Measured, So Measure The Right Things

If a business strategy is to be the shortest lead time provider, but the organization tracks and reports only cost measures, people will strive to "look good" on the cost measures, and may, in fact, work counter to the stated strategy. Performance measures must concentrate on the primary manufacturing/repair strategy, because people focus on what is measured. To deal with combination business strategies that have multiple and potentially conflicting performance measures, there are at least three ways to communicate the relative importance of each set of measures. For example, assume a business strategy of being the fastest/shortest lead time provider (primary objective) while reducing cost (secondary objective). Yet time can be established as the primary objective over cost by using more time-based measures than cost-based measures to drive performance. Another way is to review the primary measures (e.g., time-based measures in the example given) more frequently than secondary measures. Finally, the third way to communicate the relative importance of performance measures is to clearly state how each measure will be used in reviewing organization and/or employee performance.

Design Principle No.3 Measures Need To Be Used Where The Work Gets Done, If Performance Is To Be Corrected And Not Just Monitored

Performance measures need to be established and displayed where the work is actually getting done if they are to be used to detect and solve problems as they occur. Performance measures that are presented only at higher levels (i.e., above the shop floor) and/or only periodically reported arrive too late to do anything but monitor performance. The best performance measures are those that are continually updated and displayed for all to see directly in the work area responsible for the performance.

Design Principle No.4 Measures Should Be Simple And Few

Simple measures are the best measures because they are clear and straight-forward to people who need to use them. Complex ratios that relate more than one aspect of performance are difficult to interpret and can hide what is really happening in the business. Financial measures can also hide what is really happening in the business due to the "Black Box" way many financial measures are obtained. For example, a 32% cost increase in processing an order transaction might be a result of an overhead allocation algorithm (fewer orders placed in a reporting period means that more overhead has to be allocated to each order), instead of representing a real increase in order transaction cost. Better measures are those that people can understand, like time per unit and total volume. In short, measures need to be simple enough that people immediately know if activities are successfully supporting the organization's business/manufacturing/repair strategy. If the strategy is sound and people use performance measures to continually improve activities, then the financial aspects will take care of themselves.

Design Principle No.5 Performance Measure Trends Are More Important Than Performance Measure Values

The real importance of performance measures is not so much their particular value, but rather if they are getting better or worse (i.e., trend information). This trend information can be used to:

- Identify when aspects of a manufacturing/repair process are out of control, similar to the use of statistical process control (SPC) charts for part value and attribute data

- Determine the effectiveness of reengineering and continuous improvement efforts.

Monitoring trend information to project future performance can enable an organization to detect and avoid problems before they significantly affect its ability to execute a business/manufacturing/repair strategy.

Design Principle No.6 Goals Should Be Set To Drive Performance

Setting goals to drive performance is useful for providing the continuous "push" towards an improved competitive position in the marketplace. These goals need to be realistic, and congruent with the business/manufacturing/repair strategy.

Competitive benchmarking can be used in goal setting, as it provides an understanding of the performance level needed to compete effectively with existing and potential competitors. Understanding the performance gap between you and your competition is also an excellent way to focus reengineering and continuous improvement efforts.

Design Principle No.7 Someone Needs to Be Accountable

Finally, someone or some organization needs the authority to implement, and accountability for any given performance measure. A common trait of ineffective performance measures is that they are high-level measures that cross multiple organization lines for which no one organization or person is accountable. When performance is "broken", it is regarded as a result of the "system". Without authority, effective performance measures cannot be implemented. Without accountability, however, there is little or no incentive for improving performance.

2.2 Example Performance Measures in Support of a Time-Based Business Strategy

Once leading private sector firms define their business and manufacturing/repair strategy they are ready to define supporting performance measures.

Supporting measures are usually defined for each stage of the manufacturing/repair enterprise, shown in Figure 2.1. The fact that a manufacturing/repair enterprise is only as strong as its weakest link (e.g., one missing part, one unavailable drawing, one unavailable tool, etc., can stop an order) highlights the need to govern the entire manufacturing/repair process with measures that support the business/manufacturing/repair strategy.

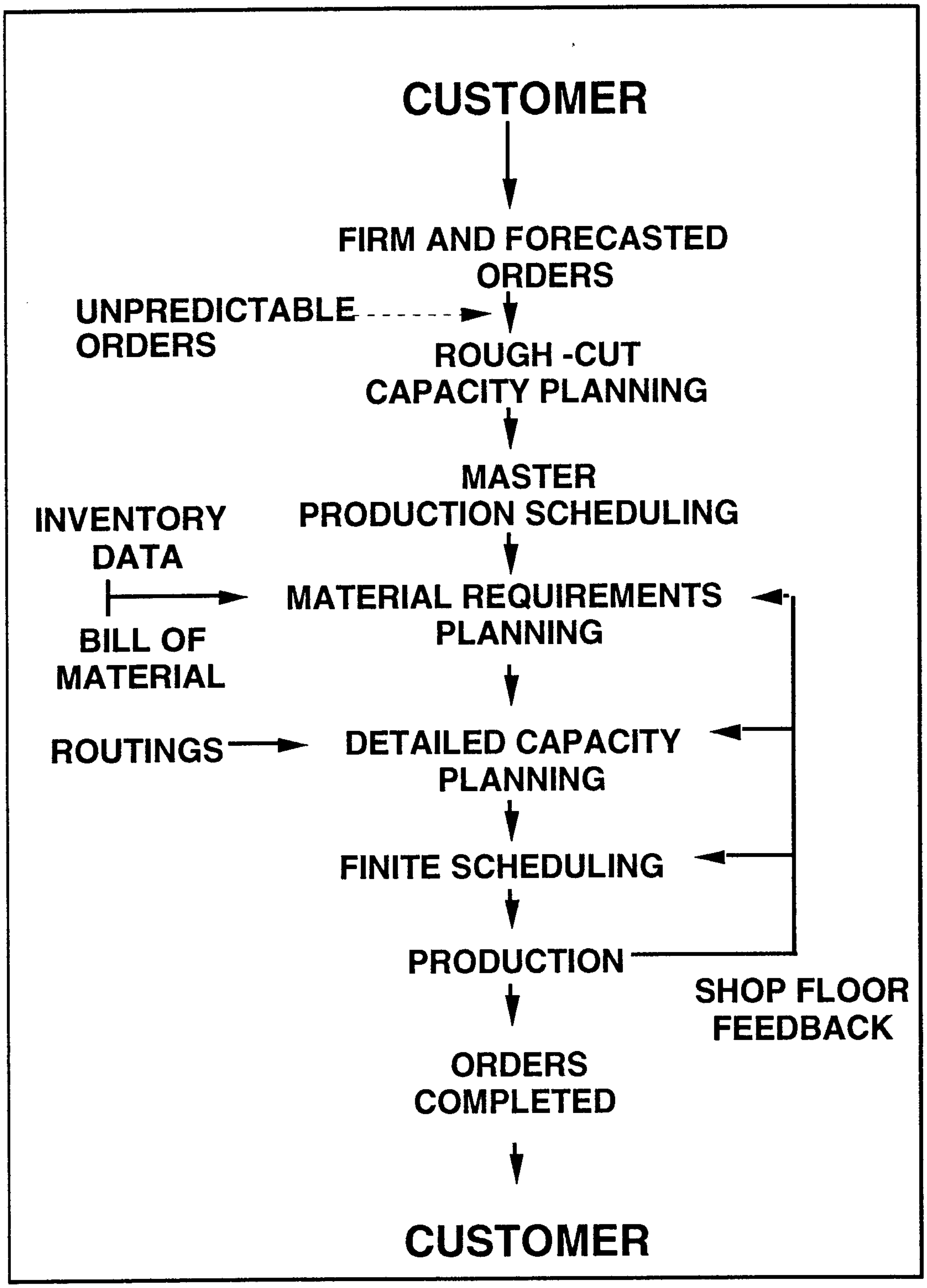


Figure 2.1 Overview of Manufacturing/Repair Planning, Control and Execution

The following examples are representative performance measures that support the manufacturing/repair enterprise, shown in Figure 2.1. For the purposes of illustration, only performance measures that support the business strategy of becoming the fastest/shortest lead time provider are discussed. This strategy was selected for illustration as it most closely aligns with one of the two key C-141 Production and TI strategies emerging from their on-going reengineering efforts. (The other key strategy, Becoming the Highest Quality/Lowest Cost Provider, would be positively affected by the successful completion of this reengineering effort).

Customer-Manufacturer Performance Measures

World class manufacturers pursuing a strategy of becoming the fastest/shortest lead time provider to customers pursue a continuous reduction of cycle-times and improved customer service. A number of measures can be adapted to gauge the effectiveness of cycle-time and customer service levels. The measures apply primarily to the two customer order receipt and delivery interfaces shown in Figure 2.1, and are summarized below.

Example 1. Customer Service Times

Customer service time tracks the time associated with the entire process depicted in Figure 2.1, from when a customer places an order all the way through until products are delivered to the customer. This measure is often used in make-to-order companies since the responsiveness of the manufacturing/repair system is critical. Data is usually collected by time-stamping orders when they come-in, and time stamping orders when they are completed. The difference between these two times is the customer service time. This measure, reported daily or weekly, represents the overall "pipeline" performance of the manufacturing/repair enterprise.

Example 2. Past Due Orders

As the objective of becoming the fastest/shortest lead time provider begins to be achieved, the issue of schedule adherence becomes increasingly important. A number of measures are available to track schedule adherence. The simplest is a daily/weekly count of the number of orders that are past due. This measure can also be tracked by manufacturing/repair area and/or by product type.

Example 3. Delivery Reliability

Delivery reliability is an expansion of the past due performance measure. This measure tracks the percent of orders completed on time, the percent of orders within 3 days of scheduled delivery, 7 days, etc. A graphical representation of this measure shows service level over time (e.g., 65% of

orders filled on time, 85% of orders filled within 3 days of scheduled delivery, 98% of orders filled within 7 days).

An important consideration for both the past due and delivery reliability measures is the use of a scheduled delivery date versus the customer's required delivery date. The scheduled delivery date may be different from the customer's required delivery date. Ideally, performance measures should track both so that service level can be measured from the point of view of the customer's stated requirement rather than according to the planned delivery date. There are many valid reasons for these dates not being the same, but not measuring performance against the customer requested date can create a false impression of real customer service level performance.

Example 4. D:P Ratio

This ratio is a comparison of "D", delivery-lead-time, or the amount of lead time given by the customer for any particular order, to "P", production-lead-time. Production lead time is the amount of time needed for manufacturing/repair to produce the order. If the value of "D" is less than "P" that means the customer's lead time is shorter than the production lead time, and an organization will not be able to manufacture the part in time to meet the customer's required delivery date. This requires that items will need to be produced to stock if customer need dates are to be met.

If the value of "D" is greater than "P", manufacturing/repair has enough sufficient production time and goods can be produced to order. The D:P ratio is an excellent way to determine how your manufacturing/repair enterprise needs to operate to ensure on-time delivery, as well as identifying benefits associated with increasing customer lead time "D" and/or decreasing production lead time "P".

Production Performance Measures

Production encompasses much more than actual manufacturing/repair, as indicated by the planning, scheduling, and feedback reporting functions shown in Figure 2.1. A number of time-based performance measures (in addition to past due orders and delivery reliability measures) can be adapted to monitor and correct the effectiveness of these functions.

Example 5. Schedule Changes

The effectiveness of production planning and control can be assessed by tracking the number of customer generated schedule changes affecting orders already released to manufacturing/repair. Frequent schedule changes can indicate material problems and/or excessive expediting, which is an indication of a scheduling process not in control (from an SPC point of view).

Example 6. Average Age of Work Orders

Tracking the average age of work orders in production can provide trend information revealing a possible "back-up" in the production pipeline. This trend information can be used to detect problems before they result in missed delivery dates.

Example 7. Cycle-Time Analysis

Tracking production cycle-time in terms of average, lowest, and highest values provides on-going information on actual production lead-time, as well as providing insight on how production lead time compares to minimum "spindle" time.

Example 8. Routing Accuracy

Routing accuracy is an important contributor to efficient part flow through the shop floor, as well as effective capacity planning and scheduling. Tracking routing accuracy is an important feedback to the planners in support of continuous improvement of the work control document development process. The leading vendors in the shop floor control arena and the American Production and Inventory Control Society (APICS) have established the need for routing accuracy to exceed 95%.

Example 9. Support Functions By Time Class

Support function by time class performance measures track things like percentage of jobs planned in 0-4 hours, percentage planned in 4-8 hours, setups completed in 0-2 hours, etc. These measures can be adapted to most of the planning and scheduling functions shown in Figure 2.1.

Material Performance Measures

No single element can disrupt the production process and cause delivery delays as fast as material problems can. People shortages can be mitigated through cross-training, equipment shortages may be mitigated through the availability of general purpose equipment, but a shortage of material can be in an insurmountable problem. Performance measures that ensure effective material planning and delivery functions are critical for eliminating this common cause of production delay.

Example 10. Material Availability

A straight-forward measure of material availability is what percent of schedules can be released to

the shop floor successfully versus the percentage of schedules that had to be delayed due to material non-availability. One potential pitfall: the impact on cost of increased material availability due to greater investments in inventory is usually the only cost impact measured. The offsetting cost of reduced manufacture/repair flow days is, unfortunately, not considered. Both sides of the equation need to be subject to cost/benefit analysis, particularly in a Lean Logistics environment with its emphasis on reducing inventory to just-in-time levels (see example 12 below).

Example 11. Inventory Accuracy

An important measure in terms of material planning and determining if schedules are supportable is inventory accuracy. Common industry goals for inventory record accuracy exceed 95%.

Example 12. Service Level and Inventory Cost

The most common measure of inventory performance is service level or the availability of material when requested. This can be represented by:

(Total Material Requisitions-Number Of Stock Outages)/Total Material Requisitions

Service levels are a function of safety stock, and impact the effectiveness of strategies such as just-in-time inventories. As safety stock increases, service levels can be expected to increase. A good measure to track is service level as a function of inventory cost, as it identifies the point of diminishing returns regarding how much customer service additional inventory investment is buying an organization.

Example 13. Bill of Material (BOM) Accuracy

Accurate material planning without an accurate bill of material is not possible. Common industry goals for bill of material accuracy exceed 98%.

Example 14. Inventory Turns

Inventory turns refer to the average amount or value of inventory on-hand at any one time compared to the total amount or value of inventory used during the year. If an organization's average inventory is 1 million dollars, and its manufacturing/repair enterprise consumes $10 million dollars a year in inventory, it has an average inventory turn of 10. This is a measure of your inventory "velocity" or how often stock is "turned-over'. This measure can be calculated by product and/or by class of material.

For Further Information:

The very useful text on performance measures is:

Performance Measurement For World Class Manufacturing. Brian Maskell, 1991. Productivity Press. ISBN 0-915299-99-2

A good reference that addresses manufacturing strategy and related performance measures is:

Strategic Manufacturing: Dynamic New Directions for the 1990s. P. E. Moody, 1990. APICS. ISBN 1-55623-193-8.

Additional references that can contribute to lean logistics and cycle-time reduction associated with parts flow are:

One Piece Flow. K. Sekine, 1990. Productivity Press. ISBN)-915299-33-X.

The Transition to Agile Manufacturing. Montgomery, Hostick, et, al., 1995. ASQC Quality Press.

3.0 Assessment of Existing and Planned C-141 Production, Supply, and TI Performance Measures

Existing and planned C-141 Production, Supply, and TI performance measures were reviewed in terms of:

- Proposed metrics,
- Lack of measurements,
- Inappropriate measurements,
- Conflicting measurements.

This review was completed by:

- Identifying the business/manufacturing/repair strategy and performance measures used by each organization,
- Determining if existing and planned performance measures adequately support the organization's business/manufacturing/repair strategy, and
- Determining if the strategy and supporting measures are compatible across the three organizations (i.e., the pipeline view).

The results of this review are presented in the following sections. Recommendations are summarized in Section 5.

3.1 C-141 Performance Measures

The business/manufacturing/repair strategy being pursued by the C-141 Management Directorate can be derived from the vision statement produced by their recently completed parts availability reengineering study.

> "We take pride in providing parts to our customer (mechanic) in the most expeditious and cost effective manner, by eliminating wait time and maximizing production through an automated, paperless system. This ensures production of a high quality, fully mission capable C-141 aircraft in minimum flow/cycle time. Our process supports a continuous improvement environment to carry us into the 21st century".

Translating this vision statement into more generic business/manufacturing/repair strategy terms

indicates that the following primary and secondary objectives are being pursued:

Primary Objective:	Fastest/Shortest Lead Time Provider
Secondary objectives:	Highest Quality Provider Lowest Cost Provider (inferred)

Existing and planned C-141 performance measures potentially relevant to C-141 Production and TI interactions were sorted and reviewed to determine how well these primary and secondary objectives are being supported.

C-141 Time-Based Measures

Existing:

- Actual aircraft flow days versus Aircraft/Missile Maintenance Production Compression Report (AMREP) flow days for Center Wing Box (CWB) / Programmed Depot Maintenance (PDM) and Paint.

- Number of planned versus actual aircraft.

- CWB/PDM/Paint aircraft on station status reports.

Planned:

- RDD/EDD effectiveness - How often does Required Delivery Date (RDD) match Estimated Delivery Date (EDD)?

  - total number of transactions
  - total time EDD trails RDD
  - if not a match, average wait time
  - EDD accuracy

- Percent of on-time turn-ins (Due In From Maintenance {DIFM}) by mechanic.

- Schedule effectiveness

  - RDD accuracy, total times RDD changed, difference between RDD and schedule operation date

- Delivery time accuracy - how long from warehouse or arrival on base until it gets to aircraft manager

- Mission Capability (MICAP)- total quantity, National Stock Number (NSN), from time MICAP initiated, how long it takes to work it, and how long until part comes in.

C-141 Cost-Based Measures

Existing:

- Direct output per man-day
- LJ profit/loss
- Direct yield
- Production efficiency
- Total cost, Depot Product Standard Hours (DPSH)
- Organic revenue
- Organic profit/loss
- MICAP hours.
- Organic expenses.

Planned:

- Mechanic Productivity- actual hours versus standard hours.

C-141 Quality-Based Measures

Existing:

- Defects-critical/major.

Planned:

- Customer satisfaction - complaints- suggestions cards in forward supply area (FSA)

- Mission capability rate.

C-141 Process Support-Based Measures

Existing:

- Aircraft cannibalization (CANN) rates
- AFTO Forms 22 greater than 45 days
- AFTO Forms 22 processing time
- AFTO Forms 135 greater than 60 days
- AFTO Forms 135 processing time

Planned:

- Stock effectiveness in the FSA - are items in FSA being used or should other items be stocked?

  - list of NSNs that have had no issues in the past 120 days
  - list of all FSA NSNs with a total number of issues over past 30, 60, 90, and 120 days

- BOM accuracy - consumption required versus turn-in or shortage for task assigned
- Number CANNs listed by aircraft manager/branch
- Tracking temporary bills of material- for planning/forecasting use
- Operation completion accuracy - does mechanic sign off operation at completion?
- DIFM turn-in at FSA by mechanic to DIFM clearance
- Percentage accuracy of what mechanic turns into actual inventory results.

Observation No.1: Planned Measures Significantly Strengthen The Ability To Support Business/Manufacturing/Repair Strategy

The emphasis of the planned C-141 performance measures are time related and process related.

This emphasis on time and process (as compared to the significant, existing emphasis on cost measures) will greatly assist LJ in its efforts to meet aircraft flow day targets, and enter the Lean Logistics environment. In short, the planned measures are in better alignment with the LJ strategy of becoming a fastest/shorter lead time provider.

Observation No.2: Establishment of RDD-Based Measures Are The Cornerstone To Meeting Flow-Day Objectives

The C-141 production activities have positioned themselves to drive LJ/TI interactions using realistic, verifiable RDDs. This is a key measure as it directly relates to the AMREP flow days. The RDD represents a potential universal measure that could be used to prioritize support activities across all three (C-141 Production, LGS, TI) organizations.

Observation No.3: Two Additional Performance Measures May Enhance C-141's Existing and Planned Set Of Performance Measures

The first potential measure(s) relates to example 4, D:P Ratio, discussed in Section 2.2. D:P ratio highlights the need to consider the demand-lead-time, as well as the production-lead- time. Translating this concept to C-141 production terms, some measure or set of measures is needed to capture the amount of lead time provided with RDD on parts requests. Potential measures include the average length of lead time placed on TI, how close to the earliest point in time in the Evaluation & Inspection (E & I) phase, and/or the subsequent PDM "fix phase" of the process was the need for the part detected, etc. (NOTE: we realize that there is not a clean demarcation between the various phases of an aircraft PDM. This simplification is for use in this study only).

Although outside the scope of the Statement of Work, a second useful measure relates to example 3, Delivery Reliability, discussed in Section 2.2. We suggest that more emphasis be placed on existing tracking mechanisms for AMREPs. Standard PDM flow days for an airframe should be the metric unless it is changed within the first 30 days for a non-paint PDM or 45 days for a depaint PDM. This would track with the stated goal of Major General Smith, the WR-ALC commander, who wants to measure Center performance against the original AMREP dates, while providing the ALC and its customers a meaningful measure by which to determine C-141 PDM issue effectiveness.

3.2 Supply Performance Measures

The business strategy which emerges from a review of LGS performance measures, presented below, consists of a dual focus on being both a fast lead time provider (fill rate measures), and controlling their (LGS') costs (stock fund ratio).

Supply Time-Based Measures

- Due in for overhaul in-transits (percent over 30 days)

Supply Cost-Based Measures

- Stock fund ratio (dollars spent vs. dollars in sales)

Supply Process Support-Based Measures

- Issue effectiveness
- Match rate
- Stock effectiveness
- WR-ALC fill rate
- Item manager ratio

Observation No.4: Focusing LGS's Business Strategy May Yield Benefits To The Overall Production Pipeline

Establishing a more clearly defined LGS business strategy that is in alignment with C-141 Production's business strategy offers the potential for improving the overall pipeline flow of aircraft parts and components. This potential could be achieved by using a consistent set of performance measures across the two organizations. For example, aligning both organizations towards a business strategy based on minimizing aircraft flow days could change the emphasis of LGS's performance measures. New, time-based performance measures could be developed that offer the potential to improve customer service levels without sacrificing cost effectiveness. Potential time-based performance measures are presented in the next observation.

Observation No.5: Potential Time-Based Performance Measures To Align LGS And C-141 Production Strategy Of Reduced Flow Days

RDD-Based Measures

Need dates translated from MILSTRIP priorities often bear little resemblance to actual RDDs generated by C-141 Production. Using RDDs as a standard measure of priority will assist in aligning LGS activities with C-141 Production activities. A number of supporting measures based on RDD could also be developed. For example, instead of simple fill rate measures, LGS could track the percentage of RDDs that were met, be it a MISTR item off-the-shelf or a locally

manufactured item from TI.

Stocking Decisions Based On D:P Ratios Instead Of Usage Activity

A case can be made for making stocking decisions not so much on usage activity, but on an individual item's D:P ratios. This is an alternative to dropping stock items after a year of inactivity to reduce inventory costs. Using D:P ratios, items with D:P ratios less than "1" would be candidates for stocking because these items have a demand lead time shorter than the production lead time required to make it. Items with D:P ratios significantly larger than "1" could be dropped from stock, because the lead time required by TI to make the part is well within the lead time C-141 Production has available. This is a radical concept compared to current LGS stocking decisions, which are primarily stock fund cost-oriented. While LGS is bound to a certain extent by the "rules" of the DoD/Air Force Supply System, we believe sufficient latitude exists within that structure to allow for the types of stocking decisions discussed above, and we believe it has such potentially significant advantages that it merits investigation by WR-ALC.

Customer Service Level Versus Cost

Although LGS has customer service measures (e.g., fill rate), and a cost measure (stock fund ratio) they do not have a measure that directly relates cost to customer service level. Their increasing involvement with the C-141 aircraft production reengineering initiative provides an opportunity to review and revise their metrics which are even more customer-oriented. A measure similar to Example 12 -Service Level and Inventory Cost, presented in Section 2.2 is recommended.

3.3 TI Performance Measures

The business/manufacturing/repair strategy being pursued by the Technology & Industrial Support Directorate is clearly defined by their Reengineering Vision statement.

> "Vision- To be the premier Department of Defense rapid response manufacturing capability for aircraft components and more"

This vision statement translates into a manufacturing/repair strategy of being a fastest/shortest lead time provider.

Existing and planned TI performance measures potentially relevant to C-141 Production and TI interactions were sorted and reviewed to determine compatibility with their quick response manufacturing/repair strategy, as well as being compatible with C-141 Production and LGS performance measures.

TI Time-Based Measures

Existing:

- Critical items - on time delivery index
- A/C major routed items flow days
- Shoetag flow days.

Planned:

- Issue effectiveness against the RDD of the customer
- Issue effectiveness against the "negotiated" supplier delivery date.
- "Red tag" shop floor processing flow measurement. A visual measure of whether an "urgent"/MICAP item is being processed under "spindle time only" rules, or is stopping in queues in the shop.

TI Cost-Based Measures

Existing:

- Organic profit/loss
- Organic revenue
- Organic expense
- Labor productivity - total yield
- Labor productivity - direct yield
- Total cost, DPSH
- Labor Productivity (Output per man-day)
- Overtime.

TI Quality-Based Measures

Existing:

- Defects
- Quality Deficiency Reports (QDR) investigated
- Customer feedback cards

TI Process-Based Measures

Existing:

- Drawing requests-paper
- AFTO Form 22 > 45 days
- AFTO Form 252 > 120 days
- AFTO Form 843 > 45 days
- Sick leave usage
- Division sick leave usage
- Safety
- On-the-job mishap rate
- CANN rates
- Aircraft fastener workload.

Observation No.6: Planned Green, Yellow, Red Tag Measures Significantly Enhance TI's Quick Response Strategy

Definitions:

- Green Tag: Process in order of final delivery date without breaking setups
- Yellow Tag: Process at next setup change; do not break setup
- Red Tag: Process at spindle time only; break setups or work overtime as required.

The planned green, yellow, red tag measures being pursued by TI are equivalent to an embedded

control strategy that automatically focuses the shop floor on time-critical orders. The tags are a form of a visual signal of the D:P measure, which compares demand lead time to production lead time.

Observation No.7: Use Of RDD vs CTT Or EDD May Better Align And Simplify Measures Between C-141 Production And TI

Currently, three performance measure bases are being considered:

RDD = C-141 Production's Required Delivery Date (when C-141 Production says they need the part)

CTT = Customer's Tolerance Time (a measure of the time between when it is possible for a customer to notify the supplier of a request, plus the supplier's lead time and the customer's RDD. It takes into account the customer's ability to impact his own tolerance time by earlier need identification and request to the supplier)

EDD = Estimated Delivery Date (when TI says they can delivery the part)

CTT could still be used in inventory level setting for the production support inventory by identifying those items which would be "late-to-need" if action is not taken to pre-manufacture/pre-stock them. Using RDDs as the foundation for TI's time-based performance measures instead of EDDs unifies performance measures across the pipeline, providing greater pipeline visibility, and removes any ambiguity regarding customer service levels between C-141 Production and TI (e.g., EDDs being met but not the RDDs needed).

A RDD-based metric would also assist in programmed workload planning. Annual, negotiated PDM requirements, linked to PDM standards, could give both LJ and TI a solid projection of not only how many aircraft components are going to be worked, but also when they will be required throughout the year. While customer-driven or other changes to the overall PDM schedule inevitably occur, thus effecting the projections, this metric could still serve as a useful aid to annual workload planning.

Changes to a RDD-based metric would also expose lead time problems in TI, as well as demand-lead-time problems in C-141 Production (delays in identifying/communicating parts needs within C-141 Production results in unattainable RDDs). Root causes for missed RDDs could be determined, based on after-action investigations, leading to resolution of performance problems associated with both TI production lead time as well as C-141 Production demand lead time and LGS supply support lead time.

Additionally, a RDD-based metric could also help the ALC determine the financial impact of missed RDDs in terms of the amount of dollars lost, as measured in hours or days, due to the item

not being delivered to the aircraft production unit on the RDD. Commercial airlines estimate that an aircraft delayed in PDM costs them $78,000/day of delay, making avoidance of delay a significant motivator for these profit-driven organizations. LJ estimates that a C-141 delayed on the ramp at Warner Robins costs the ALC $12,000/day of delay. Highlighting this financial impact would provide managers another data point for key decisions such as prioritization of selected manufacturing/repair requests and make or buy decisions for "critical item" stockage.

Observation No.8: Potential Measures To Further Support TI's Time-Based Manufacturing/Repair Study

There are several performance measures that TI may want to consider expanding. First, a number of customer service level measures could be developed based on how well TI meets RDDs. These measures could include percentage met on time, in RDD+5 days, RDD+10 days, etc. Secondary measures could address root causes of missed RDDs, like material shortages, skills shortages, unattainable lead times from C-141 Production due to capacity problems, etc.

Expanding the measures that currently track production lead time or flow days is also important, keeping in-line with TI's vision statement that the ultimate goal is to continually reduce production lead time. These measures could be by shop, major component, or by labor content (average flow-days for items requiring 1-10 std hours of labor, 10-30 hrs, etc.). Measures that break-apart flow days into its constituents (0.5 average days in planning, 1.1 average days in scheduling, 0.5 days setup, 1 day material delay, 4 days in manufacturing/repair) may provide the information needed in future continuous improvement efforts.

3.4 "Pipeline" View Assessment

Four significant observations result from completing an assessment of the use of performance measures across the C-141 Production/LGS/TI production pipeline. These observations are captured below:

Observation No. 1P: The Business/Manufacturing/Repair Strategy Across The Three Organizations Is Not Well Defined

The TI Directorate has a fast response manufacturing/repair strategy, the C-141 Production has a fast response with cost control manufacturing/repair strategy, and the Business Strategy used by LGS (based on a review of their performance measures) appears to focus on customer service and cost control. Defining an integrated business/manufacturing/repair strategy is the first step in implementing compatible performance measures across the three organizations. This step should be completed by a consensus of C-141 Production, LGS and TI management.

We recommend that fast response flow strategy be the primary business/manufacturing/repair strategy of choice, based on leading practices in private industry. The reason for this emphasis on time is that shortening the flow cycle by eliminating delays and non-value activities results in cost reduction as a by-product. In short, if you do business right, costs will take care of themselves.

Observation No. 2P: A Single Unifying Measure, Based On RDD, Is Needed To Align Performance Measures Across The Pipeline

We recommend RDD as the measure of choice because it represents the best measure of C-141 customer need, and because it directly relates to the aircraft AMREP flow day measure. Valid RDDs are the equivalent to "sub-AMREP" dates at the part/component level. The importance of total pipeline visibility cannot be overemphasized. The key to success is in each organization not measuring their own internal performance, but rather in how their performance contributes to the entire production effort (reference Design Principles #1 & 2 above).

Basing C-141 Production, LGS and TI performance measures on RDD metrics will align priorities across the three organizations. Most importantly, however, it will provide visibility throughout the C-141 Production pipeline, a perspective which is currently not available to ALC managers. This, in turn, will allow a common, ALC-wide metric for all levels of management.

Observation No. 3P: Communicating RDDs May Be A Challenge Given The Legacy Systems Used By LGS

One challenge that may be encountered is the ability of LGS's legacy information systems and work procedures to support the use of RDDs versus need dates determine by MILSTRIP priorities and other methods. This may be a candidate for a LGS-led reengineering effort.

In addition to the primary measures of RDD and related metrics, secondary measures are needed to ensure effective manufacturing/repair planning. These secondary measures address many of the production support activities (e.g., material requirements planning, rough-cut and detailed capacity planning), shown in figure 2.1. Performance measures that support manufacturing/repair planning presented in section 2.2 include:

- Example 8: Routing Accuracy
- Example 9: Support Functions by Time Class
- Example 10: Material Availability
- Example 11: Inventory Accuracy
- Example 13: BOM Accuracy

Capacity Availability, while implied in the Production Performance Measures (Examples 5 - 9) must also be carefully considered for effective manufacturing planning. Capacity Availability

refers to knowing whether or not you have the capacity to meet a certain proposed schedule. If a potential supplier lacks production capacity due to a non-availability of equipment, facilities or skills, alternatives need to be pursued, either by the supplier (i.e., additional short term labor, procurement of the needed production floor space and/or equipment, etc.), or by the customer (e.g., go find another supplier).

These secondary measures address the integrity of the manufacturing/repair process, and can reveal the real "root cause" behind missing RDD-based primary performance measures.

Observation No. 4P: Pipeline Goals Should Be Established For Key Measures

Once performance measures are fully established and aligned across the three organizations, goals should be established to use the performance measures to their full advantage. Given the emphasis on flow days, competitive benchmarking could be employed to establish time-based performance goals. At a minimum, information from other ALCs and Naval Aviation Depots could provide information of interest. Common basis of comparisons could be developed to take into account differences in aircraft and support shops, such as flow-days versus 1,000 hours of PDM standard labor. It may also be possible to obtain similar information from defense contractors using historical contractual data.

The understanding of other ALC and Naval Aviation Depot performance provides information on what performance is needed to lead in terms of other government facility competitors. Historical data regarding the cost of contractor support provides the level of performance needed to compete against private industries interested in performing this type of work. Additionally, we recommend that a full competitive bench marking analysis of the commercial airline industry be completed to provide WR-ALC information regarding leading private sector practices.

4.0 Conclusion

In general, each organization in the C-141 aircraft production pipeline can now achieve satisfactory performance based on existing internal metrics, while at the same time failing to support a winning business strategy as well as failing to provide superior customer service. This conclusion is based on:

- **Most existing performance metrics do not support a winning, time-based business strategy.**

For example, LGS measures key metrics such as Aircraft Issue Effectiveness and Aircraft Match Rate, and Aircraft Stock Effectiveness (Attachment II). These are all important metrics, but none of them depict whether the needed items were delivered when they were needed to avoid a missed RDD. As another example, LJ metrics measure, among other things, production efficiency and labor productivity (Attachment II) both important metrics. However, it is difficult to link these metrics to the customer's (AMC) need date.

- **Many existing metrics that are time based do not truly reflect actual customer need dates, but rather need dates that are negotiated by the supporting organizations.**

Currently within LJ, "standard" AMREPs are established by the 30th or 45th day of a PDM, depending upon whether or not the aircraft is going to be depainted, and whether any major problems are encountered during the E & I phase of the inspection. If changes result from E & I, the AMREP date is changed. However, General Smith, WR-ALC/CC has indicated that he wishes to measure performance against the original, negotiated AMREP. This puts the focus on the customer's need date and clearly supports a time-based business strategy.

Several metrics used by TI measure shoetag flowdays. This is an important focus area because shoetags represent the "hot" items which need to be expedited through the repair process. However, as the charts at Attachment II show, the measurement is internal to TI. There is no display of whether the flow days depicted met the customer's (LJ, for example) RDD.

5.0 Recommendations

5.1 WR-ALC ADOPT A C-141 REPARABLE PARTS/MANUFACTURING SUPPORT METRIC BASED ON REQUIRED DELIVERY DATES.

As stated above, each of the major players (C-141 Production, LGS and TI) have all developed metrics which measure their portion of the overall production aircraft pipeline. However, an overarching metric to measure performance of the entire enterprise, versus a component organization-driven objective, is needed. We believe that measuring the performance of all agencies involved in this process against the required delivery dates (RDD) established during the aircraft depot maintenance provides such a needed metric.

Each agency should play the lead role in developing the criteria related to ***their*** actions in the RDD generation/resolution process. For example, working with a "benchmark (representative) RDD, the C-141 Production activities would have to establish how long it takes them to get a requirement to the FSA, in terms of requirements generated both during and after the E & I phase of aircraft depot maintenance. They would also have to determine how long it takes their item managers to receive and process AFTO Forms 206, local manufacturing requests. Depending upon the results of this exercise, LJ might determine that they need to change their internal processes to allow the other agencies involved in the overall process sufficient time to complete their respective tasks in the manufacturing/repair pipeline. LGS and TI, in turn, would have to determine their own internal "RDD support time lines" which would be used in conjunction with the C-141 Production times to serve as the metric.

It is important to note that there should be a distinction between those RDDs generated during the E & I phases of aircraft depot maintenance, and those discovered after E & I. Our research indicates that the post-E & I discovered requirements are inevitably going to be those which will require extraordinary management attention throughout the process in order to meet the RDD. Because this exceptional attention can easily disrupt production activities throughout the process, the goal should be to determine what caused the post-E & I discovery and what actions can be taken to avoid this in the future (i.e., changes to work packages, etc.).

Failure to meet a RDD should be cause for investigation to determine what happened and what actions can be taken to avoid such an instance in the future. No matter how diligently an organization strives for perfection, incidents do occur which cause goals to be missed. The focus of these investigations needs to be what can be done to make WR-ALC an even better organization, versus searching for "who dropped the ball." Discovering and correcting those issues which negatively impact WR-ALC's ability to provide expeditious, highest quality support to its customers, will support the ALC's goal of further embellishing their status as a world class organization.

The bottom line, however, is that such a metric would give the ALC a common metric for total C-141 Production Pipeline visibility which the ALC now seems to lack.

5.2 ORGANIZATIONS INVOLVED IN THE C-141 DEPOT MAINTENANCE PROCESS SHOULD RE-EVALUATE THEIR PROPOSED, ORGANIZATIONAL METRICS.

In line with Recommendation 4.1 above, LJ, LGS and TI should re-examine the efficacy of their proposed component metrics to ensure that (1) they align with an RDD-based metric, and (2) they do not try to implement too many metrics, which could contribute to a lack of management focus.

5.3 WR-ALC SHOULD RECONCILE THE CURRENT AND PROPOSED INFORMATION/PRODUCTION MANAGEMENT SYSTEMS WHICH ARE USED IN THE AIRCRAFT PRODUCTION PROCESS.

While this area was not specifically covered in our SOW, we detected that the potential exists for serious conflicts/disconnects related to the depot's aircraft production information management systems. This issue was generated by user perceptions of the ALC's current and proposed information management systems.

During our interviews with representatives of all the organizations involved with the C-141 aircraft production process we received mixed signals from these users regarding the usefulness and interoperability of these systems, notably PDMSS, DMMIS and Make-IT. Each system is in various stages of activation; each system has its "champions" and "detractors". While our contract did not include an analysis of these systems, it was apparent that while the systems are not integrated, they are/will be used to a varying extent (ranging from not at all, to fully) by each of the major organizations in the C-141 aircraft production pipeline.

As WR-ALC moves towards a seamless production process, the need for a similarly seamless management/production information system is obvious. It appears to us that, currently, a system with the universal features *and* acceptance needed to make it successful does not exist. Of particular concern, the systems coming on line do not appear to possess these two critical criteria either. We believe an expeditious review by WR-ALC of its aircraft maintenance information management systems, in terms of system capability and user acceptance, is required. The potential, negative impact on the ALC's production management abilities, stemming from the lack of such a seamless management/production information system (or lack of acceptance of proposed, near term systems), warrants immediate attention. The parts pipeline is critical to WR-ALC's Lean Logistics implementation efforts; thus, a pipeline information visibility system is critical to implementing the Lean Logistics concept.

Attachment I

WR-ALC Personnel Contacted During The Study

WR-ALC/RE

Roy Abbott
Captain John Folmar
Denny Lawrence

WR-ALC/LJ

Neil Pernell
Henry Campbell
Ken Wright
MSGT. Mike Davies
Connell McCaa
Shirley Ogles
Al Smith

WR-ALC/TI

Jerry Ethridge
Joe Wilson
Woodrow Nix
Willie Greathouse
Carolin Bowman
Richard Smith
Tom Allmond
Gregory Thompson

78 ABW/LGS

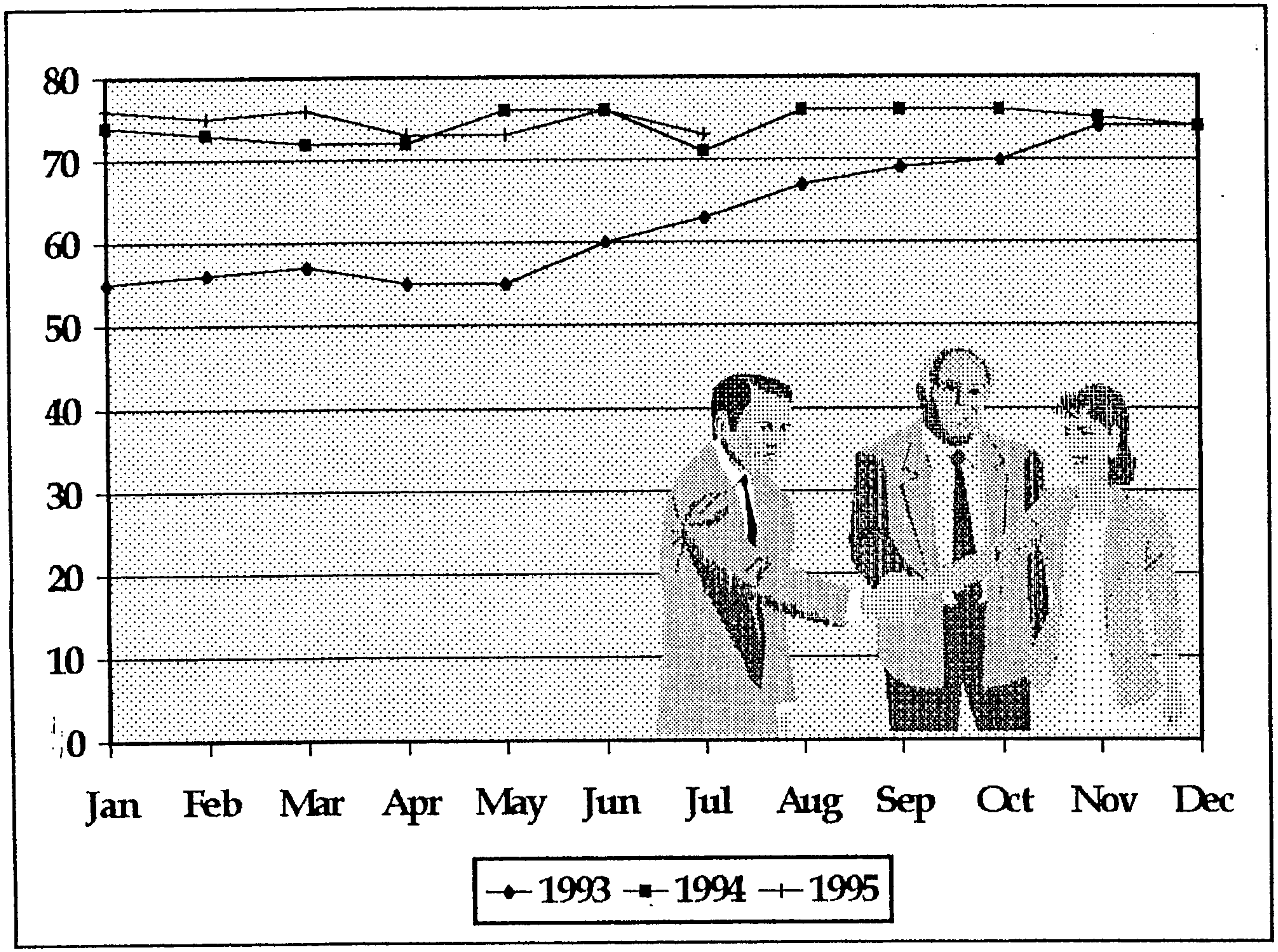
Glenn Pardon
Lonnie Thibault
Jackie Minus
Gail Ponder

Attachment II

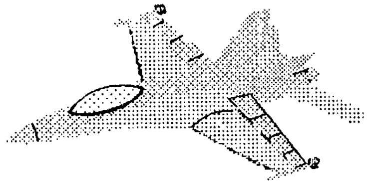
Current, Sample LGS LJ, and TI Metric Charts

- LGS Aircraft Issue Effectiveness
- LGS Aircraft Match Rate
- LGS Aircraft Stock Effectiveness
- LJ Production Efficiency
- LJ Labor Productivity
- TI FY95 Shoetag Flowdays
- TI FY95 C-141 Shoetag Flowdays

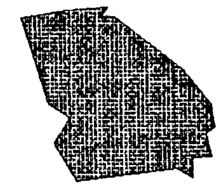
AIRCRAFT ISSUE EFFECTIVENESS

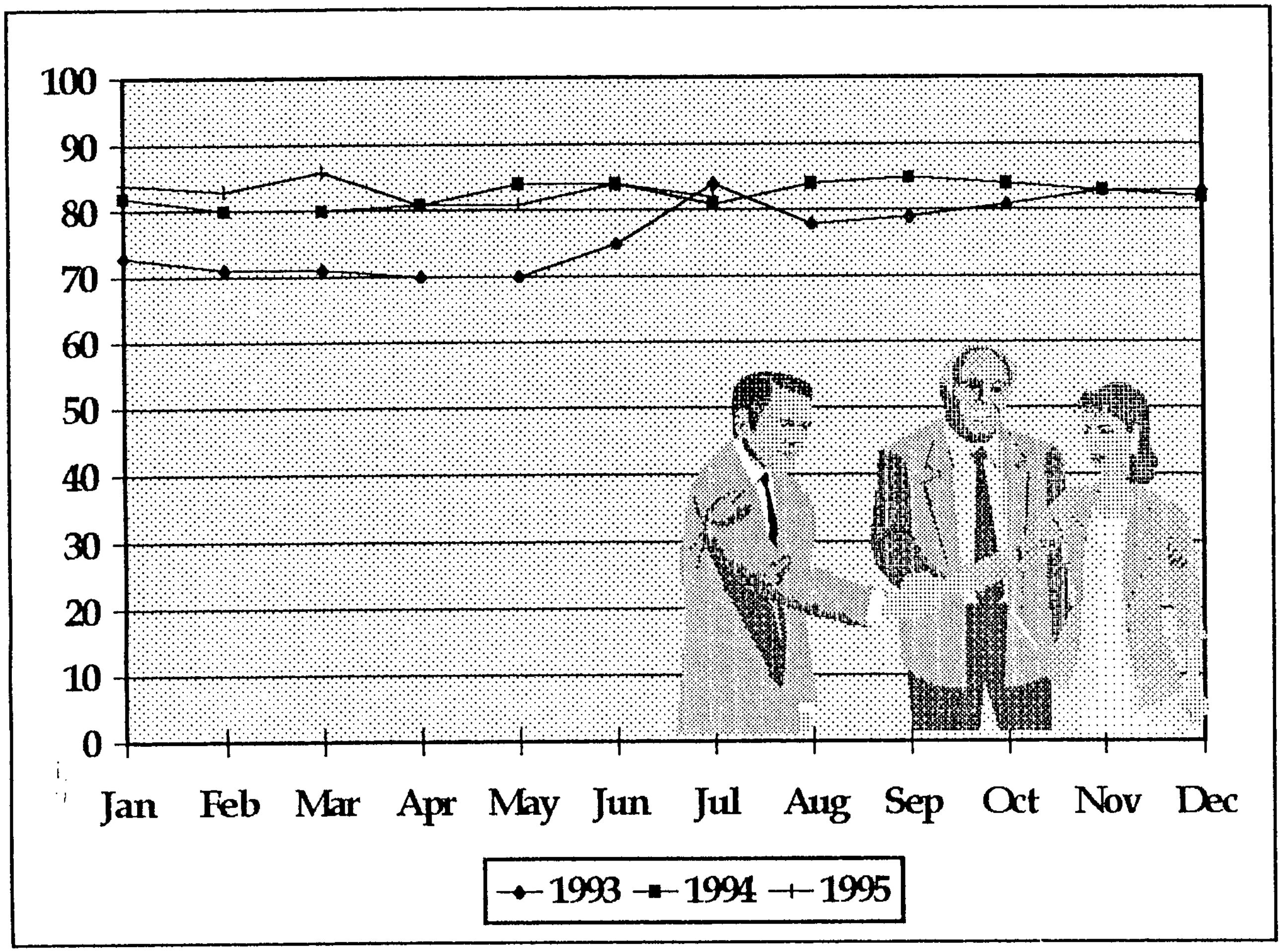


MONTH	DMDS	ISS	%
Jul-94	8548	6090	71
Aug-94	12962	9848	76
Sep-94	11156	8509	76
Oct-94	7561	5724	76
Nov-94	9588	7180	75
Dec-94	7863	5784	74
Jan-95	10958	8275	76
Feb-95	11073	8264	75
Mar-95	13324	10116	76
Apr-95	9995	7278	73
May-95	10243	7449	73
Jun-95	10623	8099	76
Jul-95	8843	6460	73

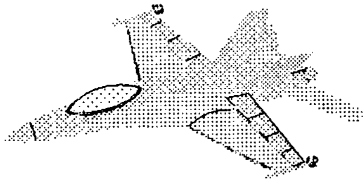


AIRCRAFT MATCH RATE

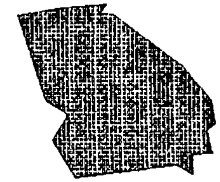




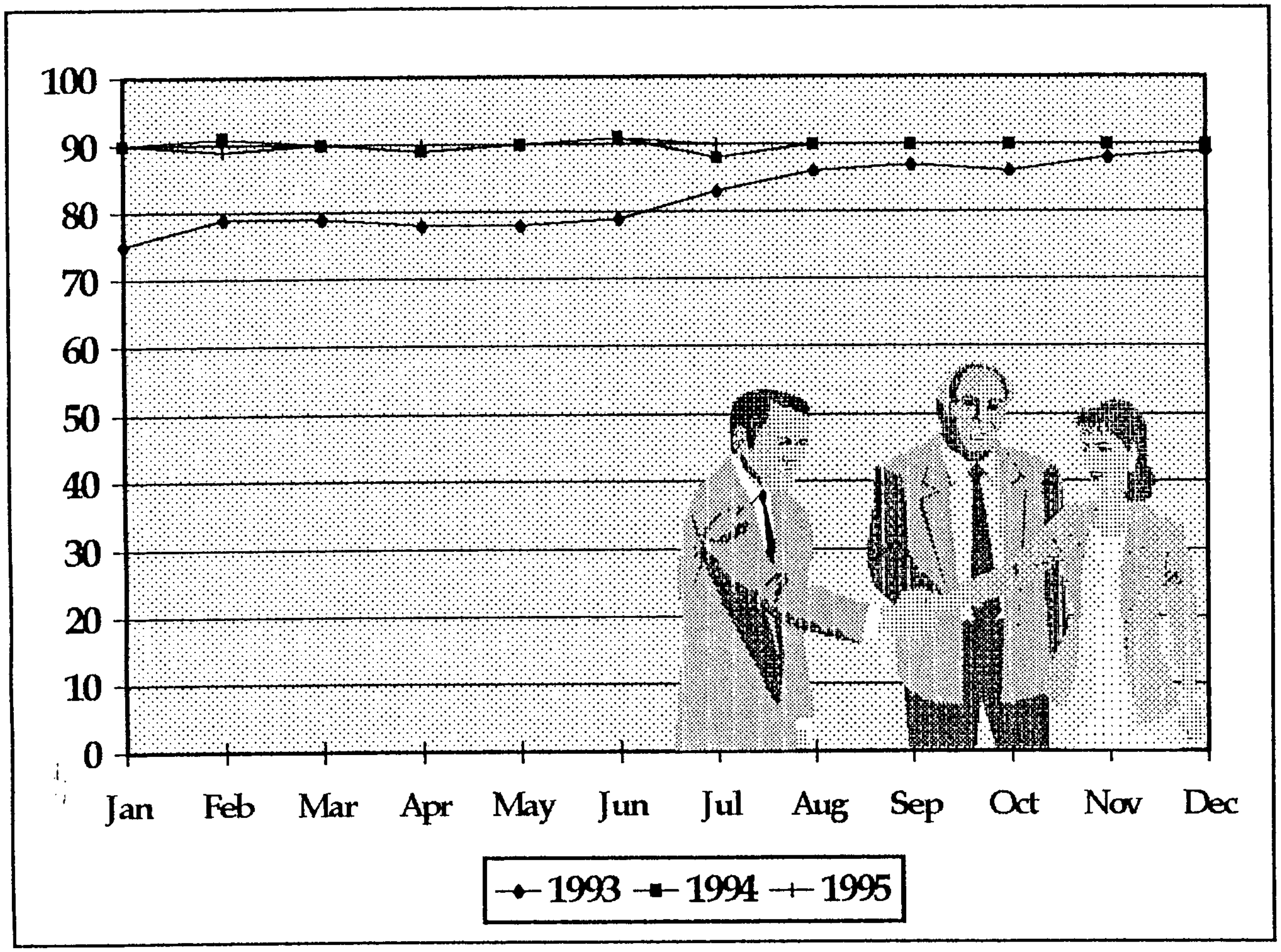
MONTH	DMDS	MATCH	%
Jul-94	8548	6941	81
Aug-94	12962	10948	84
Sep-94	11156	9467	85
Oct-94	7561	6351	84
Nov-94	9588	7994	83
Dec-94	7863	6459	82
Jan-95	10958	9212	84
Feb-95	11073	9238	83
Mar-95	13324	11267	86
Apr-95	9995	8125	81
May-95	10243	8250	81
Jun-95	10623	8880	84
Jul-95	8843	7215	82



AIRCRAFT



STOCK EFFECTIVENESS

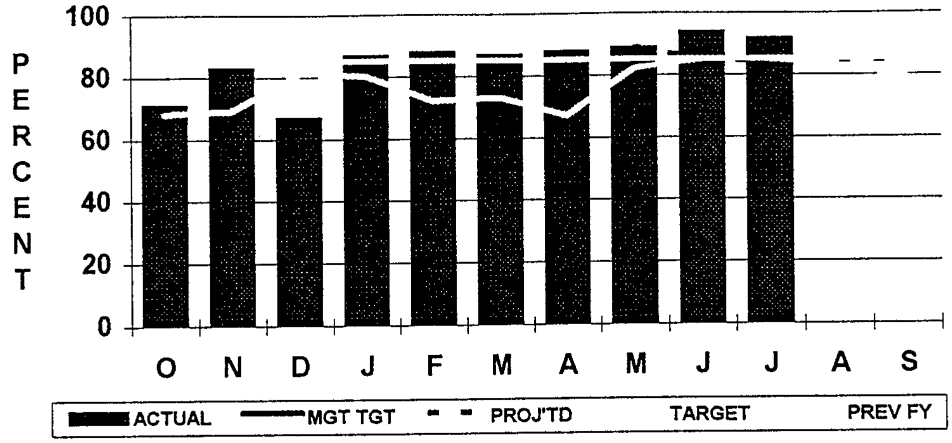


MONTH	MATCH	ISS	%
Jul-94	6941	6090	88
Aug-94	10948	9848	90
Sep-94	9467	8509	90
Oct-94	6531	5724	90
Nov-94	7994	7180	90
Dec-94	6459	5784	90
Jan-95	9212	8275	90
Feb-95	9238	8264	89
Mar-95	11267	10116	90
Apr-95	8125	7278	90
May-95	8250	7449	90
Jun-95	8880	8099	91
Jul-95	7215	6460	90

G

LJ

PRODUCTION EFFICIENCY



	O	N	D	J	F	M	A	M	J	J	A	S
ACTUAL	71	83	67	87	88	87	88	89	94	92		
TARGET	85	85	85	85	85	85	85	85	85	85	85	85
PREV FY	68	69	81	80	72	73	67	82	85	85	83	79
MGT TGT												
PROJ'TD								89	85	85	85	85

EFFICIENCY = $\frac{\text{DPEHs}}{\text{TOTAL DPAHs}}$

JUL EFFICIENCY = $\frac{120,471}{131,552}$ = 91.6%

YTD EFFICIENCY = $\frac{1,280,559}{1,522,203}$ = 84.1%

ISSUE: Actual production efficiency is slightly higher than target for JUL.

DISCUSSION: N/A

RECOMMENDATION: N/A

FACTORS BEYOND OUR CONTROL: N/A.

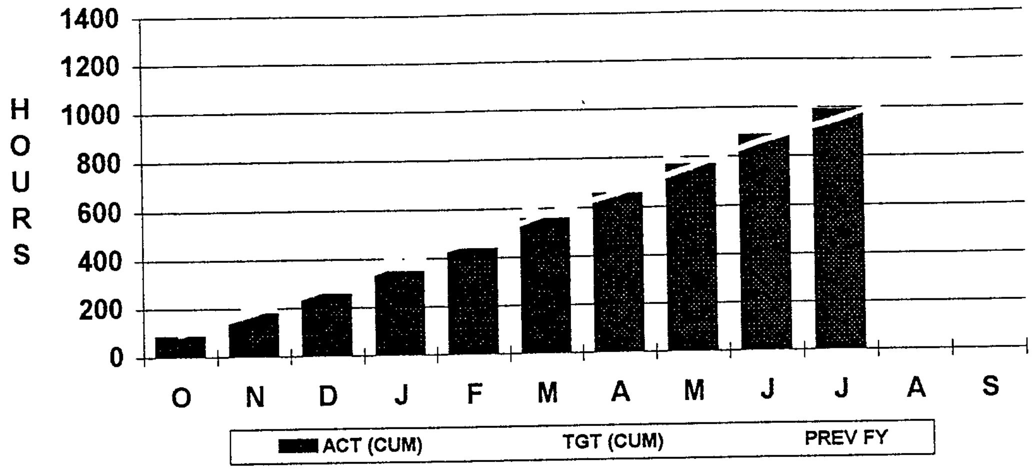
GREEN = WITHIN VARIANCE
YELLOW = NEGATIVE VARIANCE BETWEEN ACTUAL AND TARGET IS MORE THAN 10% FOR THE MONTH AND 5% FOR YTD.
RED = NEGATIVE VARIANCE BETWEEN ACTUAL AND TARGET IS MORE THAN 15% FOR THE MONTH AND 10% FOR YTD.

6.0

G

LJ

LABOR PROD (DIRECT YIELD)



	O	N	D	J	F	M	A	M	J	J	A	S
ACT (CUM)	84	179	255	345	437	557	655	769	886	989		
TGT (CUM)	102	202	303	406	502	619	716	829	940	1041	1158	1260
PREV FY	90	177	277	378	466	572	656	759	865	949	1057	1152
MO ACT	84	95	76	90	92	121	100	114	120	103		
MO TGT	102	100	101	103	96	117	97	113	111	101	117	102
% VARIANCE	18	11	16	15	13	10	9	7	6	5		

DIRECT DPEH YIELD = $\dfrac{\text{DPEHs}}{\dfrac{\text{TOTAL PAID HOURS + OVERTIME}}{\text{PAID HOURS IN MONTH}}}$

JUL YIELD = $\dfrac{120{,}471}{\dfrac{196{,}361}{168}} = 103.07$

YTD YIELD = $\dfrac{1{,}280{,}559}{\dfrac{2{,}238{,}119}{1728}} = 988.69$

ISSUE: Actual direct labor productivity is slightly lower than cumulative target through JUL and slightly higher than the target for the month of JUL. DPEHs are under target for JUL by 22,338 hours and under target YTD by 164,740 hours.

DISCUSSION: N/A

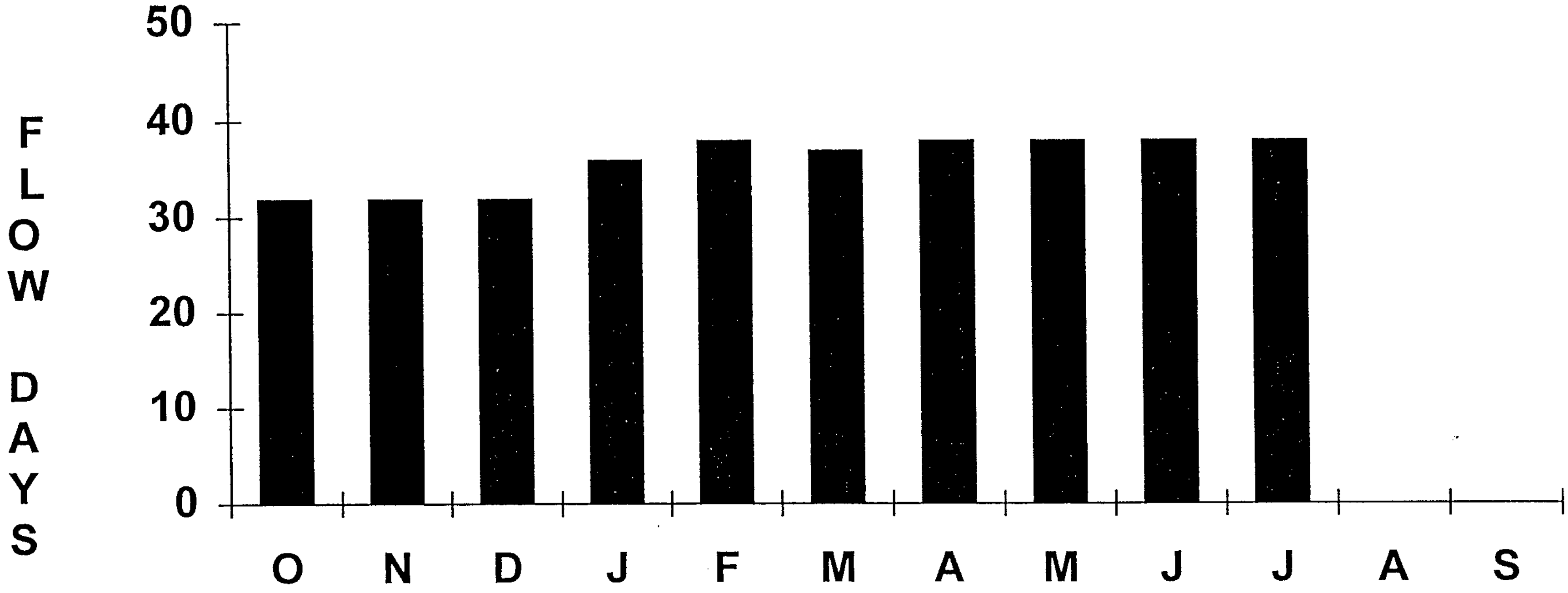
RECOMMENDATION: N/A

FACTORS BEYOND OUR CONTROL: N/A

GREEN = WITHIN VARIANCE
YELLOW = NEGATIVE VARIANCE BETWEEN ACTUAL AND TARGET IS MORE THAN 10% FOR THE MONTH AND 5% FOR YTD.
RED = NEGATIVE VARIANCE BETWEEN ACTUAL AND TARGET IS MORE THAN 15% FOR THE MONTH AND 10% FOR YTD.

TI

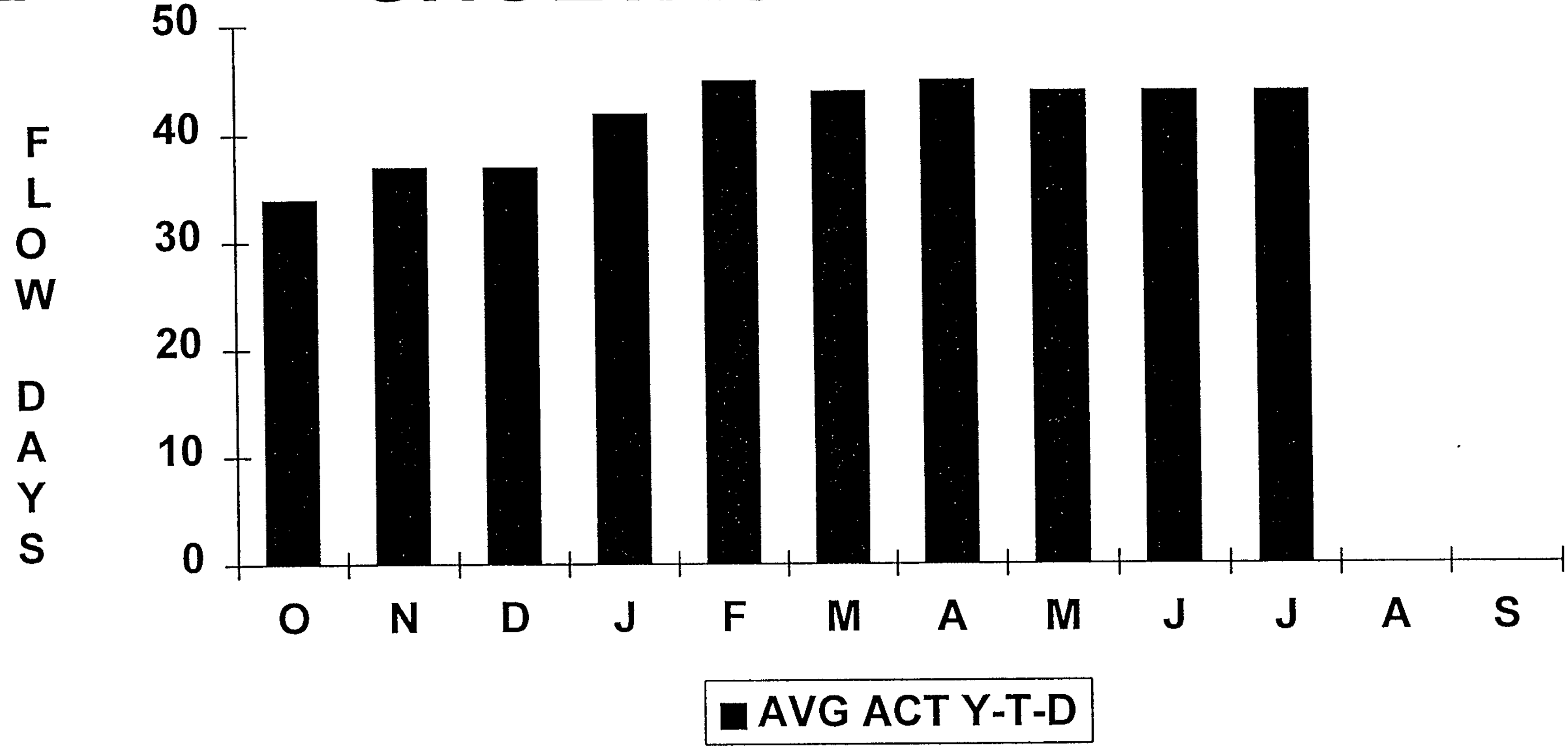
FY95 A/C
SHOETAG FLOWDAYS



UNITS PROD	211	968	1066	3250	3357	3728	4095	4244	4498	5179		
# SHOETAGS	94	206	278	389	464	606	666	758	912	1001		
AVG ACT F\Ds	32	32	32	36	38	37	38	38	38	38		

TI

FY95 C-141
SHOETAG FLOWDAYS



UNITS PROD	144	814	869	981	1056	1357	1696	1785	1838	1899		
# SHOETAGS	53	90	128	189	240	341	376	436	477	514		
AVG ACT F\Ds	34	37	37	42	45	44	45	44	44	44		